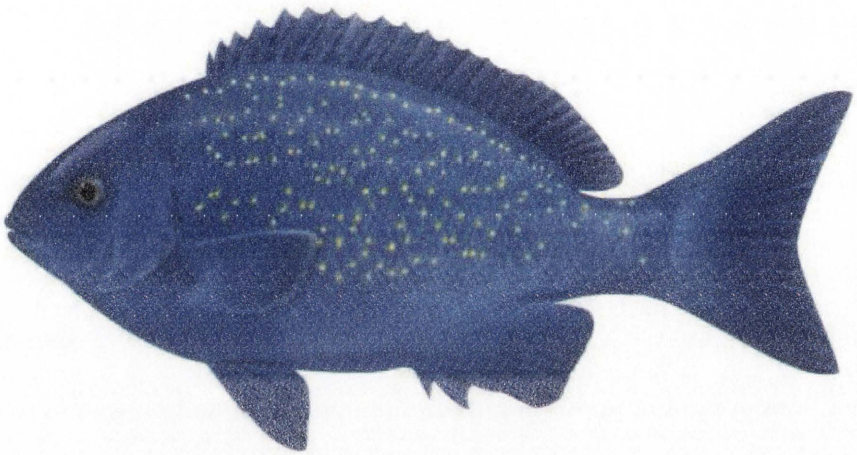
The Life History and Ecology of Bluefish, *Girella cyanea*, at Lord Howe Island



Melanie A Lewis

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Thesis submitted in fulfilment of the requirements for
the Degree of Master of Science (Research)

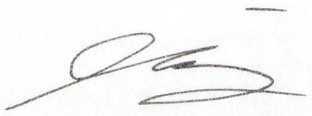
UNIVERSITY OF
TECHNOLOGY SYDNEY

Picture source: NSW Department of Primary Industries

Certificate of Authorship & Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that this thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in this thesis.



Melanie A Lewis

3rd April 2012

Thesis Abstract

Girella cyanea is a conspicuous member of the reef-fish community in the Lord Howe Island Marine Park (LHIMP), but very little is known about its life history. Rareness of this species on mainland Australian coasts in recent years has initiated a fishing ban across the state of New South Wales, however recreational fishing is still permitted on LHI. Effective management and conservation of this population requires increased information on life history and demographics. Management currently in place for this species is limited. A bag limit of 5 fish person^{-1} day^{-1} is imposed in habitat protection zones across the Marine Park. It is difficult to measure the effectiveness of this strategy, however, without the knowledge of the resource requirements of the species and how these may change throughout the course of life. This study aimed to describe distribution, diet and growth in *G. cyanea* to provide important information for best-practice management of the LHI population.

An extensive literature search was conducted for published life history, ecology and management data on Girellidae, revealing relatively scarce information for the family. A pilot study assessed the utility of a roaming survey method towing a GPS-receiver behind an observer on snorkel/SCUBA. This new method proved effective and was used for size-based assessments of habitat-use at nearshore and offshore locations around the LHI archipelago. Densities of *G. cyanea* were highest in complex rocky intertidal and rocky-reef areas. Dietary analyses helped explain this distribution, with gut contents showing intertidal green algal species (i.e. *Ulva* and *Enteromorpha*) are important food resources for post-settlement fish.

An ontogenetic dietary shift was found, with fish < 40 mm standard length (L_S) found in intertidal habitat having a mainly carnivorous diet and a digestive system without pyloric caeca. In contrast, pyloric caeca were well-developed in fish > 40 mm L_S and diets exhibited increased ingestion of algae.

Age-at-size using otoliths and von Bertalanffy parameters revealed *G. cyanea* is fast-growing and long-lived (up to 41 yrs). It is likely the transition to sexual maturity occurs between 2 and 5 years of age or 200 mm L_S. Size-based observations place fish of this life stage within complex rock habitats at depths < 5 m. Future management policies should ensure adequate (representative) areas of rocky intertidal habitat are within sanctuary zoning to protect *G. cyanea* at this important life stage.

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Ashley Fowler helped me get excited about the incy wincy teeny tiniest of fish ear bones and grinding my fingertips down to a painful level. You rock! And thank you also for commandeering the facilities at the **UNSW School of Biological, Earth and Environmental Sciences** laboratories.

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To my mum who stayed up way past her bedtime to read a lengthy document and saw all the things I could no longer see, and who cheered me on... and on... and on. Thanks **Mum** xox

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And of course, I wouldn't be me if I did not acknowledge the ultimate sacrifice of the many **bluefish** described in this research. I hope my findings serve them as I intended: in best practice management.

So what did I learn from this process? In the words of American writer Poul Anderson:

"I am yet to see any problem, however complicated,
which when you look at it the right way
did not become still more complicated."

Permissions, Permits and Funding

This study involved a species protected in part of its distributional range, and was conducted within a State and Commonwealth Marine Park listed as a UNESCO World Heritage Site. The study forms part of the Marine Parks Authority (MPA) 2006-2012 Research Work Plan, and was approved and supported by the Lord Howe Island Board.

The following permits apply:

- RNSH & UTS Animal Care & Ethics Committee (ACEC) approval RNS/UTS 0610-038A
- NSW Department of Primary Industries (DPI) scientific collections permit P05/0130-02

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Abbreviations

ANOVA	Analysis of Variance
DPI	Department of Primary Industries
EAC	East Australian Current
EAUC	East Auckland Current
GLM	General Linear Model
HPZ	Habitat Protection Zone (some fishing permitted, see p. 10)
LHI	Lord Howe Island
LHIMP	Lord Howe Island Marine Park
L_T	Fish total body length (rostrum to caudal fin tip)
L_F	Fish body length (rostrum to fork)
L_S	Fish standard body length (rostrum to last vertebrae)
MHWM	Mean high water mark
MLL	Minimum Legal Length
MPA	Marine Park Authority
NSW	New South Wales
QLD	Queensland
RTS	Roaming Transect Survey
SZ	Sanctuary Zone (no-take reserve)
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UTS	University of Technology, Sydney
UVC	Underwater Visual Census
VBGM	von Bertalannfy Growth Model